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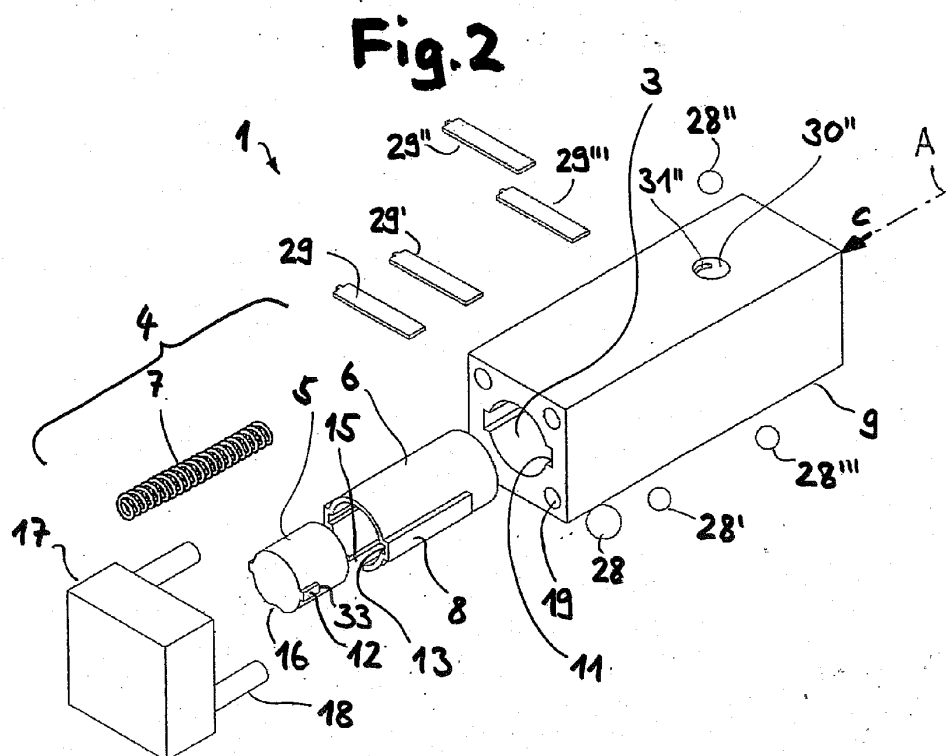
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(54) **Socket**

(57) A socket part (1) has a receiving channel (3) for receiving the plug part (2) in which a protective device (4) is displaceably mounted in the receiving channel (3). The protective device (4) comprises a protective cover (5) which can be axially moved from a closed position to

an open position and which is biased into the closed position by a helical compression spring (7). The protective device (4) further comprises an outer guide sleeve (6) which is slidingly joined to the protective cover (5) in such a way that these parts (5, 6) are telescopically extendable.



Description

[0001] The invention concerns a socket part for an electrical connection with a corresponding plug part. The socket part comprises protection means in order to prevent contamination of the electrical contacts located in a socket opening or receiving channel for receiving the plug part. Such protection means, however, may also improve child safety and lead to a more attractive outer appearance of e.g. electronic devices. The socket part particularly be used for an electronic device, e.g. a mobile phone or an audio system.

[0002] In US 6,857,884, a mobile phone with a cover for protecting a jack hole is described. The protection means of the socket part include three pieces of a slide cover which are laterally moved by the insertion force of the plug. For elastically constricting the slide cover pieces a ring-type spring is used. Each piece of the slide cover contains a T-formed legs which is supported and guided by inclined guide grooves. As a result of the multipartite build-up of this socket part, assembling and handling can be difficult. It is further possible that the socket part does not ensure a proper dust protection. The dust cover only works if the pieces of the slide cover are that precise so that gaps in between the pieces can be prevented.

[0003] It is therefore an object of the present invention to avoid the disadvantages of the known, in particular to provide a socket part which is simple to manufacture and easy to handle. The socket part shall further meet high demands regarding protection such as dust cover and/or child safety and aesthetic appearance.

[0004] According to the invention, these objects are achieved by a socket part having the features of claim 1.

[0005] The socket part for an electrical connection with a plug part includes a socket opening and an adjacent receiving channel for receiving the plug part. The receiving channel comprises protection means for closing the receiving channel or socket opening, in particular in order to prevent contamination of the electrical contacts located in the receiving channel by impurities. The inventive protection means include a protective device which is mounted displaceable in the receiving channel. The protective device comprises a protective cover which can be axially moved from a closed position into an open position. In the closed position, the socket opening is closed and in the open position the plug part is inserted. In the open position, the electrical contacts are exposed from the protection means and an electrical connection with the plug part is available. The protective device can be easily moved in a simple linear plug-in movement. With that, it is also reliably ensured that the plug part can be easily manufactured and still meet high demands regarding protection.

[0006] In a preferred embodiment, the protective device is based into the closed position particularly by means of a helical compression spring. Therewith the protective device automatically moves back into the closed position as soon as the plug is withdrawn from

the socket. The protective device can be held in an axially sprung fashion within the socket part. The protective cover can be a full body made of plastic or another isolation material. Alternatively, the cover can be a cap with a tubular portion and a cover portion whereas the tubular portion is adapted to receive one end of the helical compression spring.

[0007] The protective device can have at least one guide portion which displaceably engages into a guide groove on the socket member. Particularly advantageously, the engagement is such that the spring path is limited and such that it is held such that the protective device is fixed against rotation. For the antirotational characteristic, the protective device advantageously comprises two or more guide portions.

[0008] In a further embodiment, the protective device comprises an inner part and an outer sleeve-like part which are slidingly joined together in such a way that these parts are telescopically extendable. This embodiment provides a more guided and precise insertion of the plug into the socket and allows reducing the space required for the protective device.

[0009] The socket part can be suitable for receiving a so called jack connector having a tip portion and a cylindrical portion, whereas the diameter of the cylindrical portion is greater than the outer diameter of the tip portion. Advantageously, the inner diameter of the outer part of the protective device can be larger than the diameter of the tip portion but less than the diameter of the cylindrical portion such that it allows insertion of the tip portion into the outer part and such that the outer part is only actuated after exceeding a predetermined travel distance of the jack connector when a front face of the cylindrical portion of the plug part hits the outer part of the protective device. The two insertion sequences provide an easy and reliable push-away of the protective device in axial direction. According to a preferred embodiment, the protective cover forms the inner part and the outer part is formed by the guide sleeve.

[0010] In a further embodiment, the helical compression spring acts on the inner side of the protective cover, on the one side. On the other side, the compression spring advantageously acts on a bottom part of the socket housing.

[0011] Advantageously, said at least one cam guide is arranged on the outer casing of the protective cover and the guide cam engages in a guide groove on the guide sleeve. Thus, these two components of the telescopic protective device are secured against rotation.

[0012] Particularly advantageously, the length of the guide groove on the guide sleeve is chosen in such a way that in the closed position the front ends of the protective cover and of the guide sleeve lie approximately in the same plane or the front end of the guide sleeve projects beyond the front end of the protective cover. With this arrangement, the entrance area of the socket opening has an advantageous closing and aesthetic appearance.

[0013] The guide sleeve can have a slot. On the socket member, at least one electrically conducting contact ball can be arranged which is pressed resiliently inwardly through said slot in the closed position. The slot permits a close placement of the contact ball with respect to the axis of the plug part. Thereby it is reliably ensured that the contact ball contacts the plug part in the open position for an optimised electrical connection.

[0014] It is particularly advantageous to have an indentation arranged on the outer casing of the protective cover facing the slot of the guide sleeve or the contact ball, respectively, which ensures a closer positioning of the contact ball.

[0015] In a preferred embodiment, the socket part has a socket housing having a socket member which forms the receiving channel and a bottom part which is joined to the backside of the socket member.

[0016] The bottom part and the socket member advantageously have, on their mating surfaces, projections and especially pins on the one side and recesses and corresponding pin openings on the other side engaging in one another. The engagement can be in such a way that the bottom part and the socket member are detachably held together.

[0017] Another aspect of the present invention is an electronic device comprising a socket part as described above. Preferably, the electronic device can be a mobile phone or a music player. Other electronic devices such as audio systems would also be conceivable. Alternatively, the socket part can be part of a female electrical connection device for the connection to a power network. This socket part may be integrated in an electrical wall outlet mounted on a wall.

[0018] Further advantages and individual features arise from the following descriptions of embodiments and from the drawings, wherein:

Figure 1: shows a mobile phone with a socket part according to the invention,

Figure 1a: shows a female electrical connection device for the connection to a power network with a socket part according to the invention,

Figure 2: shows an exploded perspective view of a socket part,

Figure 3: shows another perspective view of the socket part according to figure 2,

Figure 4: illustrates the socket part just before the insertion of a plug part, and

Figure 5: illustrates the plug part according to figure 4 after a first insertion of the plug part.

[0019] Figure 1 shows a mobile phone 10 having a

socket part 1 in which a plug part 2 of a jack connector, e.g. a TRRS connector for ear phones (including optionally a micro phone) or a connector for a single micro phone, can be inserted. The respective insertion direction is indicated by the arrow c. The socket part is arranged on a lateral sidewall 27 of the mobile phone 10. The socket opening 23 of the socket part 1 is closed by protective device 4. This protective device will next be described.

[0020] The inventive socket part can also be used in other areas of application. For example, such socket parts may also be advantageous in female electrical connection devices for power supply. For receiving an electrical plug having two metal pins such a female mating would comprise two or three socket parts each having the inventive protective device.

[0021] In Figure 1a a female electrical connection device for the connection to a power network which can be mounted on a wall is shown. The openings 23' and 23" for receiving plugs of a plug are closed by protective devices 4 according to the invention. Unlike the embodiment of Figure 2 having a telescopic two part protective device, for the embodiment in Figure 1a, a integral one piece device may be sufficient.

[0022] Figure 2 shows the socket part 1 for receiving a plug part (not shown). The socket part 1 comprises a socket housing consisting of a socket member 9 and a bottom part 17. In the socket member 9, a clearance hole is arranged extending along an axis A. The clearance hole defines a receiving channel 3 in which a protective cover 5 and a guide sleeve 6 can be displaceably mounted. The two housing pieces 9 and 17 consist, for example, of plastic material, preferably being injection-moulded. However, other materials such as ceramics can also be used. For the connection of the pieces to each other, the bottom part 17 has two pins 18 and on the mating surface the socket member 9 there are pin openings 19. Pins 18 and pin openings 19 ensure a tight fit seat so that the bottom part 17 and the socket member 9 still are detachably held together. Additionally or alternatively also adhesives or welding may be used in order to ensure a solid fixation.

[0023] The protective device 4 is characterized by a telescopic configuration whereas the inner part is formed by a protective cover 5 and the outer part is formed by the guide sleeve 6. On the cylindrical outer casing of the protective cover 5 two guide cams 12 are arranged. The guide cams 12 with cam ends 33 engage in complementary guide grooves 13 on the guide sleeve 6. So, the cover part 5 can be axially moved inside the sleeve portion. The axial extension of guide cams 12 and guide groove 13 is such that the front of the protective cover ends aligning with the front face of the guide sleeve 6 in the closed position (see Figure 4). For the axial movement of the guide sleeve 6 in the receiving channel 3, rail like guide portions 8 are arranged on the outer surface of guide sleeve which engage in guide grooves 11 on the interior surface of the receiving channel 3. The protective device is biased into the closed position by a helical com-

pression spring 7. The spring 7 is held and supported on the bottom part 17 and pushes in axially sprung fashion the protective cover in the opposite direction of the insertion direction c.

[0024] The protective cover 5 is formed as a full body made of plastic, but may also be made of other suitable materials. The protective cover 5 is approximately symmetrical in construction and has two integrally formed guide cams at its sides. For the guide sleeve 6 preferably the same plastic material is used. The housing pieces 9 and 17 have a rectangular cross section. Naturally, the socket part according to the invention can be realised not only on housings with rectangular cross section. Also housings portions with round cross section can be provided with the axially moveable protective device in the same or a similar way.

[0025] Furthermore, Figure 2 shows an electrical contact arrangement having contact balls which contact the respective conductive zones of an inserted plug part. The present embodiment refers to a jack plug of the TRRS connector type which has four contacts. Consequently, the socket part 1 has four balls 28, 28', 28" and 28'''. The balls rest in retainers formed by conical cut-outs. As can be seen in figure 2, the contact ball 28" belongs to cut-out 30''. In order to prevent dropping out the balls are secured on the outer sides by tongue-shaped contact plates 29, 29', 29", 29'''. These contact plates hold the contact balls in the cut-outs by the force of a closing spring. The closing spring is a leaf spring which presses the ball against the contact of the plug when the plug is inserted. The metallic plate 29" is held in a slit 31''. The contact ball indicated by 28 has somewhat bigger dimensions. The contact ball 28 engages in the tapering between the tip portion and the cylindrical portion of the TRRS connector (not shown in Figure 2, see Figures 4 and 5).

[0026] The guide sleeve 6 has a slot 15 and the protective cover 5 has an indentation with an ark-shaped cross section. The contact balls 28, 28' and 28''' of the socket member 9 press resiliently radially inwardly at least partially through the slot 15 in closed position. Thereby, the contact ball 28 serves as a positioning ball for releasably fixing the fully inserted position of the plug. In the inserted position the ball 28 engages in the tapering of the tip portion and cylindrical portion of the plug (not shown). The slot 15 on the guide sleeve 6 and the indentation 16 on the protective cover 5 facing the slot 15 permit a close placement of the ball 28 with respect to the axis of the socket part 1 or plug part, respectively.

[0027] For certain applications, the protective device does not necessarily need to be a two-piece part made of plastic material. Instead of the telescopic configuration it would also be conceivable that the protective device is made of a single monolithic part.

[0028] Figure 3 shows some further constructive details of the socket part 1. The relatively short guide cam 12 has a cam end 33 facing the opening. The guide groove 13 has a groove end 14 for positional limitation

of the protective cover in the closed position. At least in the closed position the cam end 33 strikes in the corresponding groove end 14 so that a precise alignment of the fronts of the protective cover 5 and the guide sleeve 6 can be reached (see Fig. 4). As can be further seen from this figure, the cut-outs 30, 30', 30" and 30''' have a conical shape which becomes narrower entering the receiving channel 3. The lateral slots 31, 31', 31" and 31''' are illustrated by dashed lines. Further, the length of the axial extensions of the interlocking arrangements (i.e. guide groove 11, guide cam 12, guide groove 13) can be seen.

[0029] Figures 4 and 5 schematically show the front area of the socket part 1. The length of the guide groove (not shown) in axial direction on the guide sleeve 6 is chosen in such a way that in the closed position (Fig. 4) the front ends of the protective cover 5 and of the guide sleeve 6 lie approximately in the same plane. The jack connector part 2 has a tip portion 21 and a cylindrical portion 22 and in between a tapering. Figure 4 shows the first contact between the jack plug and the protective device of the socket part 1 at the beginning of the insertion. The front face of a tip portion 21 of the jack plug 2 acts on a cover portion 26 of the inner protective cover 5. When pushing the plug part 2 in direction c, the protective cover will be moved inside against the spring force caused by the compression spring 7. The diameter of the cylindrical portion 22 is greater than the outer diameter of the tip portion 21. The inner diameter of the guide sleeve 6 is larger than the diameter of the tip portion 21 but less than diameter of the cylindrical portion 22. Consequently, only the protective cover 5 is moved inwardly when starting inserting the jack plug. After a first insertion sequence, a front face 24 in the region of the tapering between the tip portion 21 and the cylindrical portion 22 acts on the front of the guide sleeve 6. This position is shown in figure 5. After this, also the outer guide sleeve will be moved inwardly when further inserting the plug part 2.

[0030] Figure 4 shows that the front ends lie in the same plane in the closed position. The side wall of a housing of an electrical or electronic device is indicated by the dashed line 27. The protective cover 5 is formed as a cap with a tubular portion 25 and a cover portion 26 whereas the tubular portion 26 is adapted to receive the one end of the helical compression spring 7. The components of the telescopic protective device are preferably made of plastic material.

[0031] Inasmuch as the invention is subject to modifications and variations, the foregoing description and accompanying drawings should not be regarded as limiting the invention, which is defined by the following claims and various combinations thereof.

Claims

1. A socket part (1) having a receiving channel (3) for

receiving a plug part (2), the receiving channel (3) comprising protection means, **characterized in that** the protection means include a protective device (4) which is mounted displaceably in the receiving channel (3), whereas the protective device (4) comprises a protective cover (5) which can be axially moved from a closed position, where it closes a socket opening defined by the receiving channel, into an open position allowing insertion of the plug part (2).

2. The socket part (1) as claimed in claim 1, **characterized in that** the protective device (4) is biased into the closed position particularly by means of a helical compression spring (7).
3. The socket part (1) as claimed in claim 1 or 2, **characterized in that** the protective device (4) has at least one guide portion (8) which displaceably engages into a guide groove (11) on a socket member (9).
4. The socket part (1) as claimed in one of claims 1 to 3, **characterized in that** the protective device (4) comprises an inner part (5) and an outer sleeve like part (6) which are slidingly joined together in such a way that these parts (5, 6) are telescopically extendable.
5. The socket part (1) as claimed in claims 4 for a jack connector having a tip portion (21) and cylindrical portion (22), whereas the diameter of the cylindrical portion is larger than the outer diameter of the tip portion, **characterized in that** the inner diameter of the outer part (6) is larger than the diameter of the tip portion but less than diameter of the cylindrical portion such it allows insertion of the tip portion (21) into the outer part (6) and such that the outer part (6) is actuated after exceeding a predetermined travel of the jack connector when a front face at the cylindrical portion hits the outer part (6).
6. The socket part (1) as claimed in claim 4 or 5, **characterized in that** the protective cover (5) forms the inner part and the outer part is formed by a guide sleeve (6).
7. The socket part (1) as claimed in one of claims 1 to 6, **characterized in that** a helical compression spring (7) acts on the inner side of the protective cover (5).
8. The socket part (1) as claimed in one of claims 1 to 7, **characterized in that** at least one guide cam (12) is arranged on the outer casing of the protective cover (5) and the guide cam (12) engages in a guide groove (13) on the guide sleeve (6).
9. The socket part (1) as claimed in claim 8, **characterized in that**

terized in that the guide groove (13) on the guide sleeve (6) has a groove end (14) for positional limitation of the protective cover (5) in the closed position.

10. The socket part (1) as claimed in claim 9, **characterized in that** the length of the guide groove (13) on the guide sleeve (6) is chosen in such a way that in the closed position the front ends of the protective cover (5) and of the guide sleeve (6) lie approximately in the same plane or the front end of the guide sleeve (6) projects beyond the front end of the protective cover (5).
11. The socket part (1) as claimed in one of claims 9 to 11, **characterized in that** the guide sleeve (6) has a slot (15) and on the socket member (9) at least one contact ball (28, 28', 28'') is arranged which presses resiliently inwardly through the slot (15) of the guide sleeve (6).
12. The socket part (1) as claimed in claims 12, **characterized in that** an indentation (16) is arranged on the outer casing of the protective cover (5) facing the slot (15) of the guide sleeve (6) or the contact ball (28, 28', 28'', 28'''), respectively.
13. The socket part (1) as claimed in one of claims 1 to 13, **characterized in that** it has a socket housing (20) having a socket member (9) which forms the receiving channel (3) and bottom part (17) which is joined to the backside of the socket member (9).
14. The socket part (1) as claimed in claim 14, **characterized in that** the bottom part (17) and the socket member (9) have, on their mating surfaces, projections and especially pins (18) on the one side and recesses and corresponding pin openings (19) on the other side engaging in one another.
15. An electronic device and especially a mobile phone (10) comprising at least one socket part (1) according to claims 1 to 14.

Fig. 1

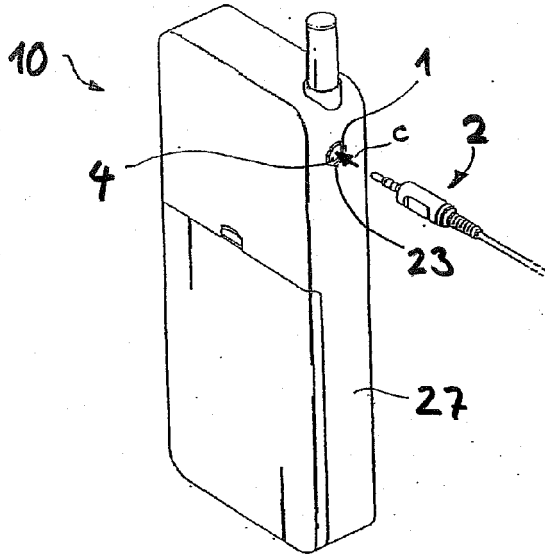


Fig. 1a

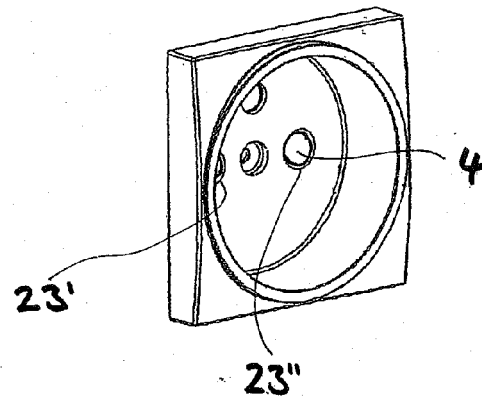


Fig. 2

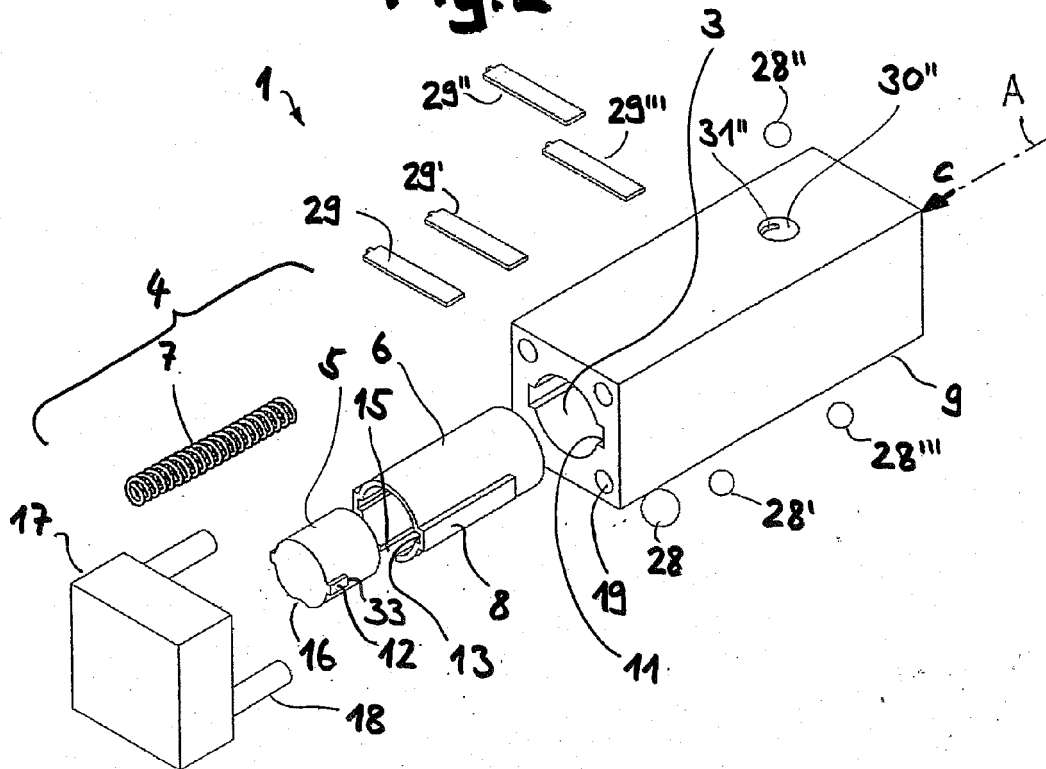


Fig. 3

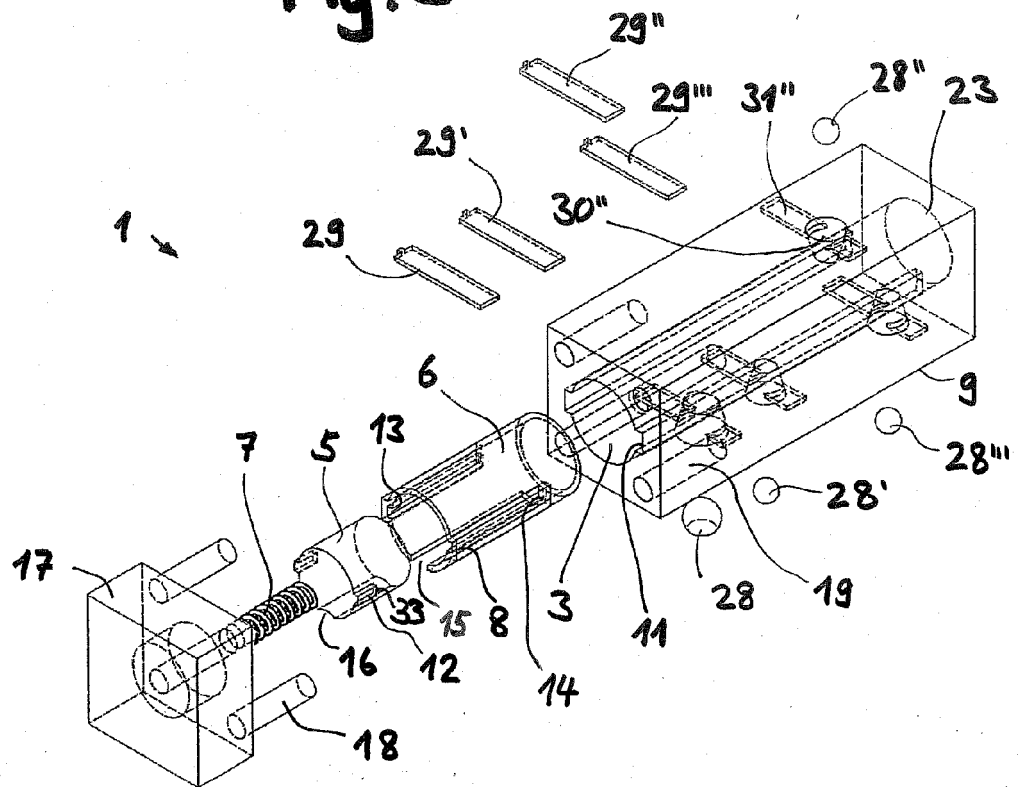


Fig. 4

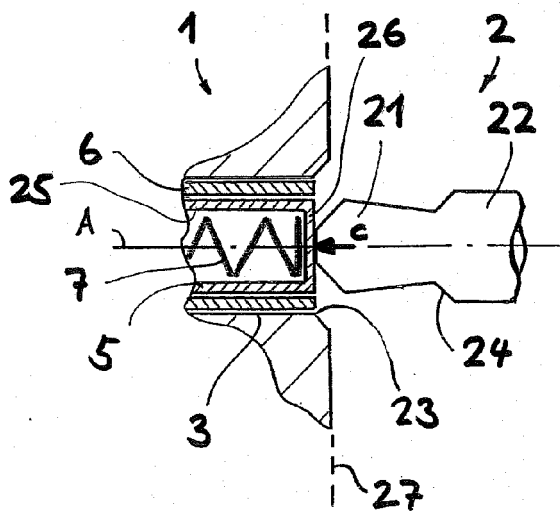
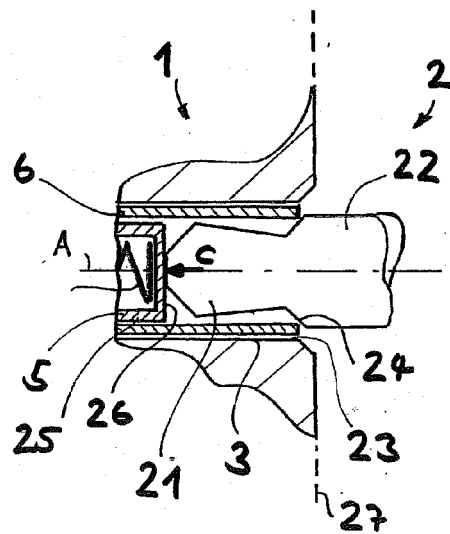


Fig. 5





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Application Number
EP 11 15 1064

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 17 May 2011	Examiner Garcia Congosto, M
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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